JAN/90

ZX-Appeal

vancouver sinclair users group

next meeting:

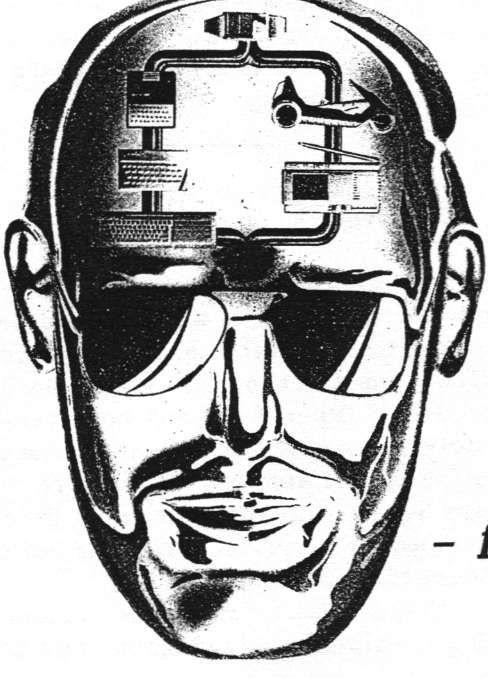
KILLARNY COMMUNITY CENTRE
6260 KILLARNY STREET
VANCOUVER

FRIDAY;7:00PM

January 12, 1990

ZXAppeal is a monthly newsletter put out by the Vancouver Sinclair Users Group. For more information on the group and ZXAppeal see the backcover.

inside



- from the mind of one man
.....quite amazing!

THIS ISSUE..........................

I hope Santa was good to all his little VSUGers and that everybody had enjoyable Holidays.

This issue we get down to some serious TS-ing: a couple of members, out of towners, have sent in some interesting programs for us to try out; we finish the 'Sinclair Story' started last issue; reprinted within is the article from 'Electronics' magazine mentioned by Harvey about Anamartic, Clive's company involved in the Wafer Scale project; Harvey returns with an article analyzing the price of DRAM over the last while. If space permits maybe a reprint or two from the exchange file. Enjoy!

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ONE MOMENT PLEASE

Queries have been received concerning the program listings from last issue. A member reports that neither the 'Line Trace' nor the 'Dominoes' program would RUN properly. These, and other programs, were photocopied (stolen) directly from back issues of Sinclair User magazine. Time constaints do not allow the pretesting of programs listed in this newsletter as it is assumed that listings taken in whole from magazines will work properly. Please let the editor know if any problems of this type become apparent in the future. To make sure this problem does not occur with member submitted listings, please submit programs on tape so that they may be tested at this end before being printed in the newsletter. As we have all experienced, it is a real #$%^?@*&$ to type in a long listing then not have it work properly.

Another member asked if Bill Harmer's program was missing line 6. Don't fret - this line was left out intentionally.
Thank you.

****

BITS&PIECES......................

...the South Bay TS Computer Club n/l reports a member uses his TS1000 as part of a setup to record earthquakes and print the results on a 2040 printer and yes he did record the recent San Fran quake. Another of their members uses his 1000, running as a portable from a car battery, to run very complex programs for his model rocketry hobby at the launch site.
...a couple of user group n/ls report the expected appearance of a new computer from Clive's Cambridge Computing. Apparently Clive has finally caved in to the inevitable - the new machine will be a 3.5 lb portable, MS-Dos, 3.5 inch disk and your choice of a 20 or 40 meg hard drive. Could be interesting as the lightest portable with a DD comes in around 5 lbs. Look for it around Apr-May.
...also reported elsewhere is that the parent company of the North American distributor for Cambridge Computing's Z88 has fallen on hard times and has retreated behind the American Bankrutcy laws. This has resulted in the Z88 importer, Cambridge North America, doing the same thing. RMG says he will not carry, or support the Z88 after the last one he has in stock is sold. Only Sharp's is still importing and supporting Z88s.

December 8/89 Minutes
-by your 'umble scribe

This was another one of them thar meetings! At 19:30 there were 14 people present. At 19:40 Gerd finished eating (and Mario finished flacking him) and Gerd announced that Glenn Read has been very busy lately and again wasn't able to make the meeting. Glenn also has the spectre to face of the Squamish highway at night. Gerd then described the pleasures of fighting Quill trying to get columnar data printed.

There was a discussion of the various methods by which we might make lists of the library software available. Harvey suggested a library disk and Harry Slot mentioned that a paper listing had already been promised to out-of-town folk.

The VP & Publisher, Rusty Townsend, was absent. Ditto the Editor & Treasurer, Rod Humphreys. (Away in the 'Windy City' on course...Ed.) Harry Slot advises that he is still the 1000 librarian, sort of. Gerd has the book library if you want something. Next month Bill Rutter will bring the whole 2068 library and hand it over to Harry.

Mario Vieira disputed the minutes of the last meeting. Harvey pointed out that there were two month's minutes in the last ZXAppeal. Mario was somewhat mollified, but doubts remain.

Harry Slot stood for the HW SIG and mentioned that Rusty had been to several auctions (swap meets, flea markets) and picked up some used TV's for the HW SIG to make into monitors. Unfortunately they were all of the hot chassis variety...

Harvey stood to present his article on the price of DRAM 1983-1989. He also mentioned an article in Electronics about Anamartic in the UK who have produced a WaferScale mass storage device; US$11K for 20Megs.

Mario laughed about how Hard Disk back-up on datasette made the mass-storage circle complete. Harry Slot warned everybody present about the dangers of assuming a single ground was used on monitor interfaces. Ken Abramson told us of modifiying the program Run the Country to the Canadian gestalt. Some students of his figured out that the way to win was to lay off all the Civil servants and drive the price of bread up to about $5 million a loaf (a little too close to realpolitik).

There followed a burst of strangeness. Nobody had anything to say. Gerd declared the meeting adjourned. It was 20:05. We all laughed & wondered what we were doing there!

Playing with Electricity

-by Harvey Taylor
-Oct 1/89

The Doc

Well for some unearthly reason I was seized by a compulsion to know in detail just what has happened to DRAM prices in the last few years. I am, by the way an inveterate magazine reader & I find it difficult to throw any of this stuff away. I saw before where someone on FidoNet had gone throw old mags and generated a data base of DRAM prices. I decided to do the same.

Below you will find first the raw data which I took from the mags, and then some graphs I drew from the data. There are several forces at play generating these prices. For the last twenty years or so memory capacity has been quadrupling every 3 years. When new chips are introduced there is a pattern of sampling, then production numbers & high prices which come down with economies of scale. As more chips of a given type are made the yield (ie. the number of good chips per batch) increases, which also makes it cheaper for the manufacturer. Depending upon demand and second sourcing of chips the price may or may not come down with the manufacturer's costs. Then there is politics. Some vested interest or other jumps up & down screaming that some competitor is cheating & bingo! Tariffs & import regulations put the price through the roof. The result of the Reagan administration embargo on memory chips in the spring of 1987 shows up clearly on the graphs.

I did not put any data on 4Meg chips in the charts. I believe that these chips have just recently dropped from approx. US$600.00 to $200.00.

All of this data is taken from the ads of MicroProcessors Unlimited in Byte & Computer Shopper. Note that the date I used is the date in the ad. All dollars are US$.

The Data

1982	16K 200ns	64K 200ns	64K 150ns	64K 120ns	256K 150ns	256K 120ns	256K 100ns	256K 80ns	256K 60ns	1Meg 100ns
Nov.		6.25	6.75							
Dec.		5.75	6.25							

1983	16K 200ns	64K 200ns	64K 150ns	64K 120ns	256K 150ns	256K 120ns	256K 100ns	256K 80ns	256K 60ns	1Meg 100ns
Jan.	1.25	4.85	5.10							
Feb.										
Mar.	1.25	4.79	4.99	5.99						
Apr.										
May.	1.35	4.89	5.09	5.90						
June	1.35	5.25	5.35	5.90						
July	1.49	5.25	5.45	6.00						
Aug.	1.49	5.27	5.47	6.55						
Sept.	1.56	5.40	5.62	6.06						
Oct.	1.56	5.65	5.95	6.27						
Nov.	1.56	5.97	6.09	6.95						
Dec.	1.56	5.97	6.09	6.97	85.00					

1984	16K 200ns	64K 200ns	64K 150ns	64K 120ns	256K 150ns	256K 120ns	256K 100ns	256K 80ns	256K 60ns	1Meg 100ns
Jan.										
Feb.	1.56	5.87	5.99	7.50	69.00					
Mar.	1.15	5.87	5.99	7.50	59.90					
Apr.	1.21	5.67	5.87	7.50	49.90					
May.	1.21	5.44	5.87	6.80	46.99					
June										
July	1.21	4.99	5.27	5.59	39.97					
Aug.	1.21	4.62	4.87	5.59	35.77					
Sept.										
Oct.	1.21	4.27	4.44		27.97					
Nov.		3.56	3.67	3.87	22.47					
Dec.		3.07	2.79	3.77	14.99					

1985	16K 200ns	64K 200ns	64K 150ns	64K 120ns	256K 150ns	256K 120ns	256K 100ns	256K 80ns	256K 60ns	1Meg 100ns
Jan.			2.39		10.95					
Feb.			1.97		8.99					
Mar.			1.69		5.77					
Apr.			1.40		4.99					
May			1.10		4.45	5.65				
June			.99		3.25	4.49				
July			1.10		2.95	4.49				
Aug.			1.10		2.85	3.75				
Sept.			1.10		2.69	3.50				
Oct.			1.00		2.53	3.25				
Nov.			1.00		2.47	3.25				
Dec.			1.10		2.47	3.25				

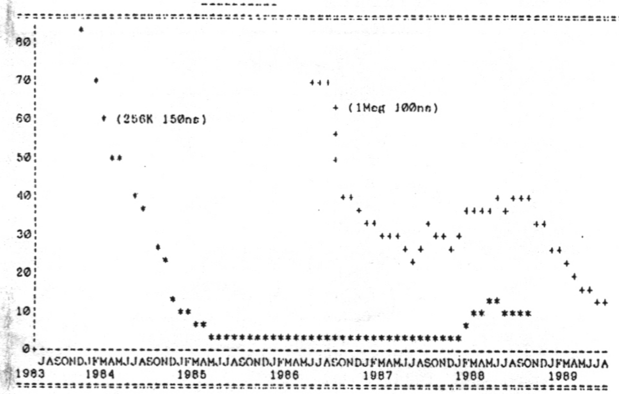
1986	16K 200ns	64K 200ns	64K 150ns	64K 120ns	256K 150ns	256K 120ns	256K 100ns	256K 80ns	256K 60ns	1Meg 100ns
Jan.			1.15		2.57	3.37				
Feb.			1.35		2.79	3.37				
Mar.			1.45		2.79		5.95			
Apr.			1.60		3.47		6.20			
May			1.40		2.95		4.87			
June			1.40		2.95		5.50			70.00
July			1.29		2.74		5.50			70.00
Aug.			1.45		2.93		5.10			69.50
Sept.			1.45		2.93		5.10			69.50
Oct.			1.35		2.75		4.85			40.00
Nov.			1.35		2.55		4.85			40.00
Dec.			1.30		2.49		3.84			38.50

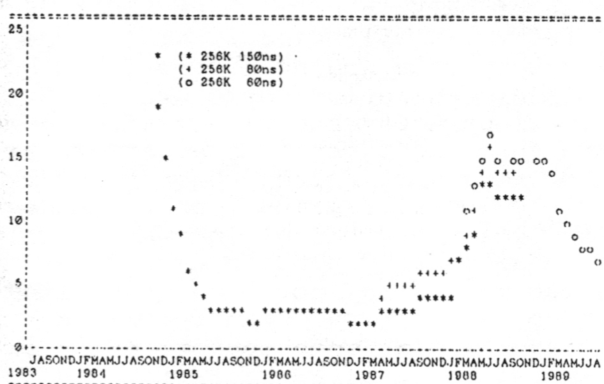
1987	16K 200ns	64K 200ns	64K 150ns	64K 120ns	256K 150ns	256K 120ns	256K 100ns	256K 80ns	256K 60ns	1Meg 100ns
Jan.			1.30		2.49		3.84			34.00
Feb.			1.30		2.19		3.59			33.00
Mar.			1.30		2.39		3.25			30.00
Apr.			1.30		3.25			4.35		28.50
May					3.35			5.35		28.50
June					3.20			5.35		27.50
July					3.10			4.95		25.00
Aug.					3.30			4.95		26.50
Sept.					3.50			5.95		32.00
Oct.					3.50			5.95		29.50
Nov.					3.55			5.75		29.50
Dec.					3.75			5.65		28.00

1988	16K 200ns	64K 200ns	64K 150ns	64K 120ns	256K 150ns	256K 120ns	256K 100ns	256K 80ns	256K 60ns	1Meg 100ns
Jan.					4.35			5.75		28.50
Feb.					6.60			7.10		36.00
Mar.					8.40			9.25	10.50	36.50
Apr.					9.25			10.85	10.95	36.50
May					12.50			14.00	14.50	36.50
June					12.95			15.50	16.00	38.50
July					11.50			13.95	14.50	37.50
Aug.					11.50			13.75	14.25	38.50
Sept.					11.75			13.75	14.50	38.50
Oct.					11.90				14.50	38.50
Nov.						12.25				33.50
Dec.						12.25			14.95	33.00

1989	16K 200ns	64K 200ns	64K 150ns	64K 120ns	256K 150ns	256K 120ns	256K 100ns	256K 80ns	256K 60ns	1Meg 100ns
Jan.						12.15			14.95	27.99
Feb.						9.50			14.50	25.95
Mar.						8.79		11.00	11.25	22.50
Apr.						7.50		7.95	9.95	18.95
May						6.15		7.50	8.95	17.95
June						5.75		7.35	8.50	16.50
July						4.40		6.75	7.95	14.50
Aug.						3.75		6.40	7.40	13.75
Sept.										
Oct.										
Nov.										
Dec.										

The Graphs





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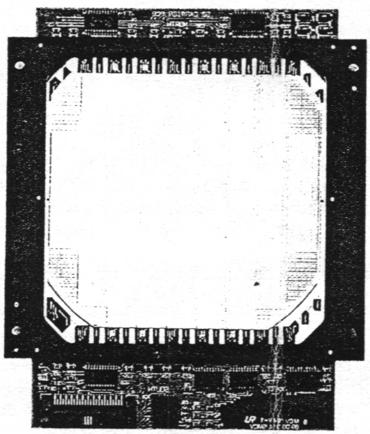
WAFER-SCALE INTEGRATION FINALLY GOES COMMERCIAL



A British startup, Anamartic, uses two of these 6-in. wafers in its solid-state disk drive, the Wafer Stack

BY BERNARD C. COLE

Wafer-scale integration, a technology that has eluded the electronics industry for the past two decades, will finally become a commercial reality this month, when Anamartic Ltd. of Cambridge, England, introduces the first wafer-level product: a solid-state disk drive.

By taking wafer-scale integration beyond the component stage and building an actual product that has an identifiable market niche, the three-year-old startup hopes to succeed where other would-be developers of wafer-scale integration technology have failed (see opposite). With this approach, the company won't have to wait for third parties to make use of its technology, says John Scandalios, vice president of marketing for Anamartic Inc., the San Jose, Calif., marketing arm of the UK firm.

Although a number of vendors offer solid-state disk drives, the market is ripe for new technology, says Louise M. Biggs, senior industry analyst at Dataquest Inc. of San Jose. Current solid-state drives are built using discrete dynamic random-access memories on densely packed printed-circuit boards.

Wafer-scale technology allows for even denser memory packing and faster access times. Among those offering DRAM-based solid-state drives are Digital Equipment, EMC, Imperial Technology, and NEC. Dataquest projects that the solid-state drive market, which accounted for just over $100 million in 1986, will near the $500 million mark in 1992.

Anamartic's Wafer Stack drive delivers access times unattainable by other solid-state disks or conventional magnetic rotating disks: an average of 200 μs using a proprietary native-mode interface and a little less than 1 ms using a Small Computer Systems Interface, the company claims. The ESE20, Digital Equipment Corp.'s solid-state drive, offers a typical access time of 3 ms using an SCSI interface. Typical access time for conventional hard-disk SCSI drives is about 20 ms.

Such speed is certain to catch the attention of computer designers, especially those building on-line transaction-processing systems now demanded by a growing number of users. OLTP systems typically handle hundreds of data-base transactions per second.

Anamartic's per-megabyte cost stacks up well compared with other solid-state offerings. The 40-Mbyte version of Wafer Stack sells for $11,680. Up to four 40-Mbyte components can be stacked to provide a 160-Mbyte configuration that costs $28,760, including controller and SCSI interface. By comparison, DEC's ESE20, a 120-Mbyte solid-state drive used on VAX and VAXcluster systems, costs about $121,000. A similar system from Imperial Technology Inc. of El Segundo, Calif., costs about $87,000. Imperial has been selling solid-state drives for about a decade to a variety of computer makers, including Hewlett-Packard Co.

Compared with conventional magnetic hard-disk storage, solid-state drives and fast access come at a premium. Storage on hard disks costs about $5 to $10 per megabyte; on Wafer Stack, it costs $100 to $200 per megabyte in volume purchases. Customers "really have to want very fast access" to justify the price of Wafer Stack's storage, says Jim Porter, Los Altos, Calif.-based disk-drive industry consultant and publisher of *Disk/Trend Report*. Porter adds, however, that "Anamartic seems to be realistic. It knows that it has to shoot for targets of opportunity that need the access advantage that it offers."

In Wafer Stack, two 6-in. wafers form a module containing 40 Mbytes' worth of 1-Mbit CMOS DRAMs. The wafers are fabricated by Fujitsu Ltd., which is also an investor in Anamartic. A controller board manages data storage and transfer, error correction, and wafer "scrubbing"—the process in which failed memory cells are purged and replaced, even if failures occur after the system is put in use.

When connected to a host computer, Wafer Stack emulates a conventional disk drive, taking up as much space as an 8-in. Winchester unit. Unlike other solid-state disks, in which individual memory chips are wired to a pc board, Anamartic's wafers are mounted to a carrier intact. Using the full wafer eliminates several processing steps, including as much as 90% of the costly wiring and soldering associated with pc boards.

Anamartic puts 202 dice, each of which contains a 1-Mbit DRAM, on a wafer, more than enough to yield 20 Mbytes. The extra dice provide spares to replace any failed elements. The 1-Mbit DRAMs are produced using a 1.3-μm n-well CMOS process. The chips are 13.65 by 4.4 mm^2, about 20% larger than standard devices to accommodate the spare cells. The DRAMs are organized as 256-Kword-by-4-bit fast-page units that require a refresh rate of 52 μs.

Each die carries additional programmable configuration logic, which Anamartic calls Conlog. The added logic connects each element to its four neighboring dice over signal lines that form logic networks on the wafer.

Using proprietary software, an external controller tests each die and programs the Conlog elements to interconnect the good dice in a single continuous bidirectional data path. The path takes the form of a spiral running from the wafer's edge to the center.

Portions of bad dice, but not the entire DRAM, are routed out of the spiral by the software. Anamartic partitions each

DRAM into 32 tiles of 32,000 bits each so that only a failed tile is ever discarded. In conventional practice, if just one bit of a 1-Mbit DRAM is flawed, the entire device must be scrapped.

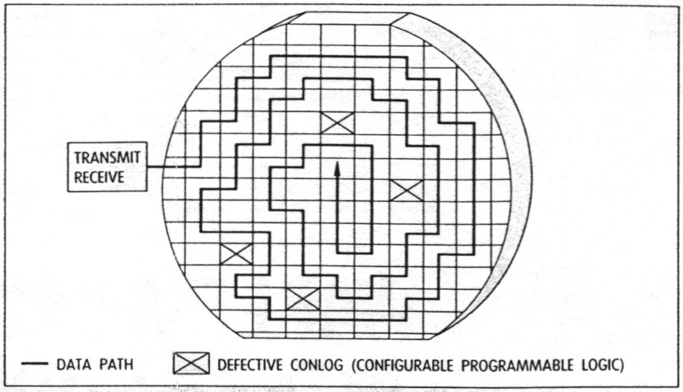
The wafer carrier is a little larger than the 6-in. wafer, says Anamartic's Scandalios. A silicon nitride layer protects the top layer of the wafers, over which a silicon gel is applied to protect the wire bonds from moisture. Two wafers are placed face-to-face in a hermetically sealed clamshell-like arrangement to form a 40-Mbyte module.

Each wafer-carrier board includes a CMOS flash programmable read-only memory, which holds the map of the Conlog spiral, including the locations of failed tiles and spare cells. The flash PROM is called into play by the controller to access only good cells after the Conlog has been established, and to activate spares if random errors crop up during scrubbing.

Wafer Stack has already drawn interest in the computer community. Tandem Computers Inc. of Cupertino, Calif.—like Fujitsu, an investor in Anamartic—"is very excited about Wafer Stack" based on early performance results, says Larry Laurich, vice president of engineering at Tandem. The company is considering replacing the hard-disk drives in its OLTP systems with Wafer Stack, he says.

One of the big attractions for Laurich is the "no latency/fast access" feature of Wafer Stack. This feature partitions a stored data base to boost system throughput. Laurich says that even though Wafer Stack storage is significantly more expensive than magnetic mass storage, it still holds the promise of being at least 50% cheaper than conventionally built solid-state disks.

HOW ANAMARTIC PULLS IT OFF



In the Anamartic scheme, each die carries programmable logic (Conlog), which, under software control, interconnects the good dice in a single bidirectional path.

Anamartic expects to stay ahead of solid-state competitors in terms of price, says David Hall, chief executive officer of Anamartic. Because Wafer Stack can use most of the memory tiles in a DRAM that has some bad bits, "we can use about 80% of the dice on a wafer," he says. "This means that Wafer Stack can be priced in volume at 60% to 75% of the price of solid-state disk drives based on individual chips." By comparison, conventional semiconductor-manufacturing techniques may result in a 75% rejection rate for DRAMs, Hall says.

Although it plans to spend much of the next year building its position in the 8-in. solid-state drive market, Anamartic is considering a number of future directions. A first step, says Scandalios, will be to reduce the size of the subsystem by replacing many of the discrete components used in the controller with a few gate arrays. Slightly redesigning the basic system and squaring off the 6-in. wafer could make a 5.25-in. drive possible. By using wafer segments, Scandalios says, 3.5-in. solid-state drives are within reach. And a shift from the present 1.3-μm process to a 1.0-μm process could boost both density and speed considerably.

In the long run, Scandalios adds, other types of memory—indeed any regular array of identical components, such as EPROMs, electrically erasable PROMs, and static RAMs—are possibilities for wafer-scale integration. □

AN ELUSIVE TECHNOLOGY EXERTS ITS PULL

Anamartic Ltd. may not be the first company to offer wafer-scale products, but it has a chance to be the first one to do so successfully.

Anamartic's game plan is much more ambitious than those of earlier wafer-scale developers, including survivors Inova Microelectronics Corp. of Campbell, Calif., and Mosaic Systems Inc. of Fremont, Calif. In fact, both Inova and Mosaic have scaled back their efforts, using their hard-earned expertise to develop wafer-scale integration as a silicon-substrate-based packaging technology.

The remaining wafer-scale efforts are at the universities or are in-house development efforts within large vertically integrated electronics companies and systems manufacturers. Among them are AT&T, General Electric, Hitachi, Hughes, IBM, McDonnell-Douglas, Mitsubishi, Plessey, and Rockwell.

Mosaic's first wafer-scale product, introduced in 1985, was based on a selective interconnection approach using silicon as a hybrid substrate. It used a proprietary "antifuse" technology based on amorphous silicon to form programmable interconnections between metalization layers. It attached ICs to the silicon substrate and wire-bonded them using standard techniques.

Mosaic targeted its offering at military and aerospace applications—without much initial luck. The company lost about $4 million last year, with sales barely approaching the $500,000 mark. Now under new management and with a second round of financing, Mosaic has altered its sights, targeting a number of new high-growth market segments, including portable computers, local-area networking, and modems. It hopes to push sales to about $15 million to $20 million by 1991.

Inova also went after military and aerospace customers in its effort to bring wafer-scale CMOS static random-access memories into the 32- to 64-Mbit range. The company based its approach on a proprietary interconnection scheme it calls Inroute. In this approach, wafers containing slightly modified standard SRAMs are fabricated by a foundry; to them Inova adds a third proprietary interconnection level that links good and partially good dice.

Like Mosaic, Inova has reformulated its marketing strategy; it is now hoping to serve the high-speed CMOS SRAM market by packaging partial wafer slices in standard memory packages. This market is expected to grow from $480 million in 1987 to almost $2 billion by 1992, according to Douglas Mitchell, vice president of marketing at Inova. Within 18 to 24 months, he says, the company will be in production with an 0.8-μm process for building a new generation of 4-Mbit SRAMs. *–B. C. C.*

```
   1 GOTO 3
   2 SAVE "CLASSIC NUMBERS"
   3 PRINT AT 10,0;"===========
STAND BY ==========="
   4 PAUSE 200
   5 FAST
   7 LET P1=1
   8 LET P2=2
   9 DIM C$(13,2)
  10 DIM F(13)
  11 DIM L(7)
  12 DIM T(7,7)
  13 LET D$="1000.500.100.50.10.
5.1."
  14 LET D$=D$+"0.0.100.50.10.5.
1."
  15 LET D$=D$+"800.300.100.50.1
0.5.1."
  16 LET D$=D$+"0.0.0.0.10.5.1."
  17 LET D$=D$+"0.0.80.30.10.5.1
."
  18 LET D$=D$+"0.0.0.0.0.0.1."
  19 LET D$=D$+"0.0.0.0.8.3.1."
  20 LET E$="<TOUCH ENTER TO CAN
CEL>"
  22 LET K$="<TOUCH ANY KEY TO C
ONTINUE>"
  24 LET S=0
  25 FOR R=1 TO 7
  30 FOR C=1 TO 7
  35 GOSUB 1499
  40 LET T(R,C)=VAL V$
  50 NEXT C
  60 NEXT R
 130 LET D$=D$+"4.3.3.2.2.1.1."
 140 FOR C=1 TO 7
 145 GOSUB 1499
 150 LET L(C)=VAL V$
 160 NEXT C
 170 LET D$=D$+"1000.900.500.400
.100.90.50.40.10.9.5.4.1."
 180 FOR N=1 TO 13
 185 GOSUB 1499
 190 LET F(N)=VAL V$
 200 NEXT N
 205 LET D$=D$+"M.CM.D.CD.C.XC.L
.XL.X.IX.V.IV.I."
 210 FOR N=1 TO 13
 215 GOSUB 1499
 220 LET C$(N)=V$
 230 NEXT N
 240 LET S$="MDCLXVI"
 270 CLS
 280 PRINT AT 5,0;"======= CLASS
IC NUMBERS ======="
 290 PRINT
 295 PRINT
 300 PRINT "SELECT -"
 310 PRINT ,,TAB 2;"1.ARABIC TO
ROMAN"
 320 PRINT ,,TAB 2;"2.ROMAN TO A
RABIC"
 330 PRINT ,,TAB 2;"3.EXIT PROGR
AM"
 340 PRINT ,,TAB 2;"4.READ ABOUT
 ROMAN NUMBERS"
 345 PRINT AT 19,0;"<ENTER 1,2,3
,OR 4>"
 347 SLOW
 350 INPUT S
 360 IF S<1 OR S>4 THEN GOTO 270
 370 IF S=3 THEN GOTO 1999
 380 GOSUB (399 AND S=1)+(619 AN
D S=2)+(1699 AND S=4)
 390 GOTO 270
 399 REM .ARABIC TO ROMAN
 400 CLS
 405 LET N$=""
 410 PRINT
 420 PRINT AT 8,4;E$
 430 PRINT ,,,,TAB 6;"ENTER ARAB
IC NUMBER",TAB 12;"------"
 435 SLOW
 440 INPUT N$
 445 FAST
 447 CLS
 450 IF N$="" THEN RETURN
 460 LET N=VAL N$
 470 IF N<0 OR N<>INT N THEN GOT
O 590
 480 LET R$=""
 490 LET FL=1
 500 LET NT=N-F(FL)
 510 IF NT<0 THEN GOTO 550
 512 FOR L=LEN C$(FL) TO 1 STEP
-1
 514 IF C$(FL,L)<>" " THEN GOTO
520
 516 NEXT L
 520 LET R$=R$+C$(FL, TO L)
 530 LET N=NT
 540 GOTO 500
 550 LET FL=FL+1
 560 IF FL<=13 THEN GOTO 500
 570 PRINT AT 10,(31-LEN R$)/2;R
$
 575 PRINT AT 20,3;K$
 577 SLOW
 578 PAUSE 4E4
 580 GOTO 399
 590 PRINT AT 10,2;"VALUE BEYOND
 PROGRAM LIMITS"
 600 PRINT ,,TAB 1;"ENTER A POSI
TIVE WHOLE NUMBER"
 605 PRINT AT 20,3;K$
 607 PAUSE 4E4
 610 GOTO 399
 615 REM
 619 REM .ROMAN TO ARABIC
 620 CLS
 625 LET N$=""
 630 PRINT AT 8,4;E$
 640 PRINT ,,,,TAB 6;"ENTER ROMA
N NUMBER";TAB 12;"-----"
 650 SLOW
 660 INPUT N$
 665 FAST
 670 CLS
 675 IF N$="" THEN RETURN
 680 LET TL=0
 690 LET F=0
 700 LET PL=4
 710 LET PC=1
 720 LET OC=1
 730 LET D=1
 740 LET RC=0
 750 LET F$=N$(D TO D)
 760 LET O$=S$
 761 LET R$=F$
 762 LET OO=1
 763 GOSUB 1090
 764 LET CC=OF
 770 IF CC=0 THEN GOTO 1000
 780 LET CL=L(CC)
 790 IF CC<>PC THEN LET RC=1
 800 IF CC=PC THEN LET RC=RC+1
 810 IF RC>3 AND CC<>1 THEN GOTO
1030
 820 IF F=1 AND CL>=PL THEN GOTO
1050
```

```
830 LET V=T(PC,CC)
840 IF V=0 THEN GOTO 1050
850 LET TL=TL+V
860 IF CC>=PC THEN GOTO 910
870 IF L(OC)<=PL THEN GOTO 1050
880 LET F=1
890 LET CL=L(PC)
900 GOTO 920
910 LET F=0
920 LET PL=CL
930 LET OC=PC
940 LET PC=CC
950 LET D=D+1
960 IF D>LEN N$ THEN GOTO 975
970 GOTO 750
975 LET R$=STR$ TL
980 PRINT AT 10,(31-LEN R$)/2;R
$
985 PRINT AT 20,3;K$
990 PAUSE 4E4
995 GOTO 619
1000 PRINT AT 10,0;"INVALID CHAR
ACTER FOUND - """;F$;""""
1010 PRINT ,,,,TAB 5;"USE ONLY M
,D,C,L,X,V,I"
1015 PRINT AT 20,3;K$
1020 PAUSE 4E4
1025 GOTO 619
1030 PRINT AT 10,0;"TOO MANY ";F
$;"'S IN A ROW",,,"(MAXIMUM 3)"
1035 PRINT AT 20,3;K$
1040 PAUSE 4E4
1045 GOTO 619
1050 PRINT AT 10,0;"INVALID CHAR
ACTER SEQUENCE -"
1060 PRINT ,,,,N$
1070 IF D=1 THEN GOTO 1074
1071 FOR A=1 TO D-1
1072 PRINT " ";
1073 NEXT A
1074 PRINT "*"
1075 PRINT AT 20,3;K$
1080 PAUSE 4E4
1085 GOTO 619
1090 LET OF=0
1100 IF OO+LEN R$-1>LEN O$ THEN
RETURN
1110 IF O$(OO TO OO+LEN R$-1)=R$
 THEN GOTO 1140
1120 LET OO=OO+1
1130 GOTO 1100
1140 LET OF=OO
1150 RETURN
1499 REM .PSEUDO R/D
1500 IF D$(P2)="." THEN GOTO 153
0
1510 LET P2=P2+1
1520 GOTO 1500
1530 LET V$=D$(P1 TO P2-1)
1540 LET P2=P2+1
1550 LET P1=P2
1560 RETURN
1699 REM .READ ON ROMAN NUMERALS
1700 CLS
1710 PRINT AT 3,9;"ROMAN NUMBERS
"
1720 PRINT ,,"THE MODERN ROMAN S
YSTEM ALLOWS","TWO-LETTER COMBIN
ATIONS IN","WHICH MAGNITUDES ARE
 REVERSED."
1730 PRINT ,,"IN THESE CASES,THE
 SMALLER","MEMBER IN THE REVERSE
 PAIR IS","SUBTRACTED INSTEAD OF
 ADDED."
1740 PRINT ,,"ALSO,A LETTER CAN
BE USED UP","TO THREE TIMES IN S
UCCESSION.","""M"" IS THE EXCEPT
ION.IT CAN BE","USED ANY NUMBER
OF TIMES IN","UNBROKEN SUCCESSIO
N."
1770 PRINT AT 20,3;K$
1780 PAUSE 4E4
1790 GOTO 270
1999 REM .CLOSURE
2000 CLS
2010 PRINT AT 10,14;"BYE";AT 21,
0;"END PROGRAM"
2020 GOTO 2020
2100 REM TO TEST PROGRAM
2105 REM ENTER 1989 INTO
2106 REM ARABIC/ROMAN CONVERSION
2110 REM ENTER MCMLXXXIX INTO
2111 REM ROMAN/ARABIC CONVERSION
2115 REM ONE NUMBER RETURNS THE
2116 REM OTHER
```

SOLDERING TIP...

Does your soldering iron overheat while on standby ?...I am sure it does, unless you have one of those very expensive temperature controled stations.

A very inexpensive solution is the HI-LO FEED-THRU DIMMER, made by LEVITON, rated at 300 watts and costing only $4.99.

It is nothing more than one of those little switches that go right on the lamp cord, with a built in diode.

A rotary knob gives in sequence, OFF, HALF and FULL power. As there are two full cicles for a full turn of the knob, I found it convenient to mark the full power position with a small round file. Instalation of the device takes a just a couple of minutes.

Marcio Vieira

CURVE SKETCHING

by Alvin Albrecht

Type in the listing (omitting rem statements and/or the instructions -line 5 and lines 1000 and up- if you want to shorten the typing job) and, if you have CK Type, do a CK type check with the CK check output following the program listing. If you deleted the rem statements and/or the instructions the lines that contained a rem statement will have different CK outputs.

Before you save this program you should know that there is a bug in it. I didn't realize this until after it was printed and the bug was so easy to correct that instead of reprinting the entire listing, I am providing the changes:

```
   130 GO TO 185
   184 PLOT x/xscale+127,
       y/yscale+87
   255 IF PEEK 23739=11 THEN
       IF PEEK 23736+256*PEEK
       23737=125 THEN GO TO 185
   257 IF PEEK 23739=11 THEN
       GO TO 184
   260 BEEP .005,20:IF PEEK
       23739=10 THEN GO TO 185
```

Now save with: SAVE "F(X)SKETCH" LINE 1

Run the program and read the instructions provided (If you omitted the instructions when you typed in the program, read them from the program listing @ line 1000). The following are some examples to make you better acquainted with how to use Curve Sketcher.

Set Range=+/- 2, Domain=+/- 2*PI, Function: f(x)=SIN X (enter SIN as a keyword. ie- as you normally would from basic)

Next graph the function three times with steps=40,20, and 10 without clearing the screen. The graphs should look inaccurate (mildly put) but there should be an improvement as the step is lowered.

Now, clear the screen, set step=3, and graph the function. This is what the graph of SIN x should look like. A step of 3 is ideal for this function because it is not too slow and it is accurate.

It makes sense that if the step is lowered further an even more accurate graph would be produced (at the expense of a longer time to graph it) and this is true, but we run into different problems. Clear the screen again and set step=0.5 and graph the function. A more accurate graph is produced but it looks fuzzy.

Suppose we want to know the roots of the equation f(x)=SIN x (ie-for what values of x SIN x=0). Set step=3, clear the screen and graph the function again. Choose the "Coords" option from the menu by pressing "O". SIN x=0 when the graph crosses the x-axis. Use the arrow keys (5 to 8 will move one pixel, CAPS + 5 to 8 will move 8 pixels at a time) to position the flashing dot on one of the points where the graph crosses the axis. The coordinates of that point are given in the bottom left corner. One of the roots is the x coordinate. If you have a calculator handy you can check this by entering x and take the SIN of that (don't forget the 2068 works in radians) and the answer should come up very close to zero. The slight inaccuracy is due to the fact that each pixel width on the screen represents several x-values. The range of x values is determined by the horizontal scale. You must also be careful in selecting a suitable domain and range. Clear the screen again and try graphing this:

Domain=+/- 5, Range=+/- 3, Step=3, Function:

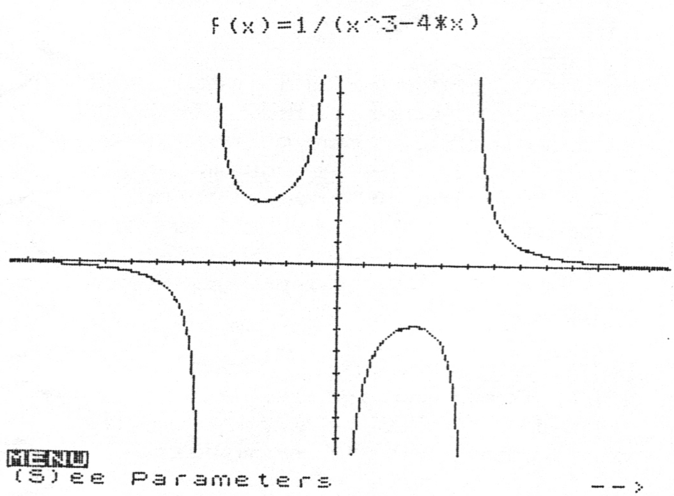
f(x)=(x+1)/(x*x-x)

Remember what this looks like, clear the screen, and graph the function with one change: Range=+/- 7. Notice the extra part of the curve? It wasn't plotted before because the section of graphpaper we used the first time had only the x-axis from -5 to +5 and the y-axis from +3 to -3. The extra parabolla's vertex is at -5.2 on the y-axis. This feature can be used to get close-ups of sections of curves for detail. Did you notice that the hump on the leftmost part of the graph was harder to see on the second graph?

One last example: Range=+/- 2, Domain=+/- 2, Step=5 Function: f(x)=LN x. Clear the screen and graph this. Why is it beeping at you? It's encountering plenty of mathematical errors. The LN function is undefined for negative numbers but the program is attempting to calculate LN x for -2<x<2 (the domain). The beeping is over fairly quickly and the graphing didn't take that long, but for more complicated expressions the computer may be wasting its time calculating futilely the values of a function at undefined points and this will cause a considerable delay in the graphing. To avoid this problem, we change Lstart. Lstart tells the computer from what PIXEL to start graphing the function from. When Lstart=-127 (the default value) it starts graphing from the left edge of the screen. If we set Lstart=0 it will graph from the centre (origin) of the graph. So to only graph the function for positive values of x, set Lstart=0. Do this, clear the screen, regraph the function, and verify that there was no beeping.

What if we want to start the graphing at a specific VALUE OF X. eg- we want to see the graph of LN x only where x>0.73. Set Lstart=0.73/xscale. Easy enough. (Try it if you like after clearing the screen and use Coords to verify the first point plotted has an x coordinate of close to 0.73).

That about wraps up my narrative. Hope you enjoy it.

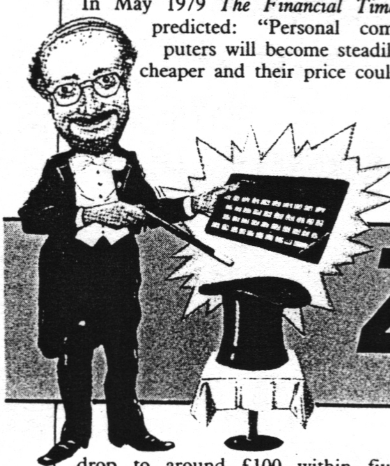


```
  1 REM CURVE SKETCHING
        Dec 1989 Albrecht
  2 POKE 23658,8
  3 DEF FN r(x)=INT (x*1000)/10
00
  5 GO SUB 1000: REM instr
 10 LET xscale=1: LET yscale=1:
 LET z=1: LET a$="x": LET lstart
=-127
 15 GO SUB 500: REM Draw Axes
 20 GO TO 400: REM Menu
 98 REM
 99 REM Draw Graph
100 REM
101 ON ERR GO TO 250
102 PRINT #0;AT 0,0;"One x=";FN
 r(10*xscale),"One y=";FN r(10*y
scale)
105 LET plot=0: LET xlast=PI: L
ET ylast=PI
106 FOR l=lstart TO 127 STEP z
107 LET x=l*xscale
110 PRINT #0;AT 1,0;"WORKING @
";FN r(x),
112 LET y=VAL a$
115 IF ABS (y/yscale)<=87 THEN
GO TO 150
119 REM
120 REM Not OK to plot
121 REM
125 IF plot THEN LET plot=NOT p
lot: DRAW (x-xlast)/xscale,(y-yl
ast)/yscale
130 GO TO 180
149 REM
150 REM OK to plot
151 REM
155 IF plot THEN DRAW (x-xlast)
/xscale,(y-ylast)/yscale
157 IF NOT plot AND xlast=PI TH
EN LET plot=NOT plot: PLOT x/xsc
ale+127,y/yscale+87
160 IF NOT plot AND xlast<>PI T
HEN LET plot=NOT plot: PLOT x/xs
cale+127,y/yscale+87: DRAW (xlas
t-x)/xscale,(ylast-y)/yscale
179 REM
180 REM Continue
181 REM
185 LET xlast=x: LET ylast=y: N
EXT l
190 ON ERR RESET : RETURN
249 REM
250 REM Non-permissable value
        found in calculations
        or out of bounds in
        plotting errors
251 REM
255 IF PEEK 23739=11 THEN IF PE
EK 23736+256*PEEK 23737=160 THEN
 PLOT x/xscale+127,y/yscale+87
257 IF PEEK 23739=11 THEN GO TO
 180
260 BEEP .005,20: IF PEEK 23739
=10 THEN NEXT l: GO TO 190
265 IF PEEK 23739=21 THEN PAUSE
 0: GO TO 190
270 LET x=x-xscale: GO TO 112
399 REM
400 REM Menu
401 REM
405 LET b$="MENU
       (S)ee Parameters
     -->"
410 GO SUB 450: GO TO 410+5*(g$
=CHR$ 13)+190*(g$="S")
415 LET b$="Change: (D)omain (R
)ange (S)tep  (L)start (F)uncti
on   -->"
417 GO SUB 450: GO TO 417+283*(
g$="D")+313*(g$="L")+333*(g$="R"
)+383*(g$="S")+433*(g$="F")+8*(g
$=CHR$ 13)
425 LET b$="(C)lear Screen
 C(O)ords    (G)raph Function
     -->"
427 GO SUB 450: GO TO 427+523*(
g$="C")+543*(g$="G")+443*(g$="O"
)-22*(g$=CHR$ 13)
449 REM
450 REM Wait for key
451 REM
455 PRINT #0;AT 0,0;b$
460 IF INKEY$<>"" THEN GO TO 46
0
465 LET g$=INKEY$: IF g$="" THE
N GO TO 465
470 RETURN
499 REM
500 REM Draw Axes and Label
        Scale
501 REM
505 CLS : PLOT 0,87: DRAW 255,0
: PLOT 127,0: DRAW 0,175
510 FOR l=7 TO 247 STEP 10: FOR
 m=86 TO 88: PLOT l,m: NEXT m: N
EXT l: FOR l=7 TO 167 STEP 10: F
OR m=126 TO 128: PLOT m,l: NEXT
m: NEXT l
515 RETURN
598 REM
599 REM View Parameters
600 REM
605 PRINT #0;AT 0,0,,,,: LET b$
="PARAMETERS
 Domain=-"+STR$ (FN r(xscale*12
7))+"<x<"+STR$ (FN r(xscale*127)
)
610 GO SUB 450: IF g$<>CHR$ 13
THEN GO TO 610
612 PRINT #0;AT 0,0,,,,: LET b$
="Range=-"+STR$ (FN r(yscale*87)
)+"<y<"+STR$ (FN r(yscale*87))+C
HR$ 23+CHR$ 0+" Step="+STR$ (FN
r(z))+CHR$ 23+CHR$ 16+" Lstart="
+STR$ FN r(lstart)
615 GO SUB 450: IF g$<>CHR$ 13
THEN GO TO 615
620 PRINT #0;AT 0,0,,,,: LET b$
="f(x)="+a$
625 GO SUB 450: IF g$<>CHR$ 13
THEN GO TO 625
630 GO TO 400
697 REM
698 REM Enter New Domain
699 REM
```


Continued next issue.

Continued from last issue.

Z80 and beyond



SINCLAIR'S SUCCESS had always been based on being first with products, often aimed at a market that didn't know it existed. By 1979 there was a well established 'personal computer' market. Commodore had launched its £700 PET home computer the previous year. Apple and Tandy were also well-known in the field. These machines were found variously in laboratories, and commercial and teaching establishments; not many people had a computer at home.

Sinclair decided that he would have to offer a product with all the essential features but at a greatly reduced price. In May 1979 *The Financial Times* predicted: "Personal computers will become steadily cheaper and their price could drop to around £100 within five years." Typically, Sinclair decided to do it in a few months.!

The ZX80 — the world's smallest and cheapest computer — was launched at an exhibition in Wembley at the end of January 1980. It measured 9″ × 7″ and cost £99.95, or £79 in kit form.

In order to keep the price low the designers had to introduce some radical ideas to reduce vastly the number of components. The biggest saving was the use of a domestic television set as a screen and a cassette player as a program and data store. The machine had a Z80A microprocessor which was supplied by Nippon Electric; a large ROM, which contained a 4K-byte specially written Basic interpreter, the character set and monitor; and the interfacing circuitry.

The ZX80 was very much aimed at the person in the street wanting to know something about programming computers. Sinclair was convinced that people could be persuaded to buy the ZX80 but *how* to persuade them was the problem. The image of the computer at that time was somewhat Big Brother; clinical, air-conditioned surroundings; huge cabinets with reels of magnetic tape whirring to and fro. How would people relate such a frightening piece of equipment to the ZX80? Why would they want to buy it for the home? Why would they want to buy it at all?

No one need have worried. The ZX80 was an immediate success; ten orders were placed at the exhibition in the first five minutes. The office in King's Parade was suddenly inundated with cheques; the switchboard was permanently jammed. Nobody had expected quite such a response and there was total chaos. Clive's immediate problem was to ensure that the company could cope efficiently both with the administration, and with the production of the ZX80.

Sinclair wanted to sell the ZX80 in the United States, although he did not expect to find an enormous market there because of the strength of the competition in the home computer field. However, a few weeks before the launch of the ZX80 in the UK he took it to the Las Vegas Consumer Electronics Show, and at the same time met Nigel Searle in Boston. Within a few days Searle had a new job, a new apartment and an office in Boston. He sold the ZX80 and later the ZX81 in the States from that office by mail order until early 1982.

Sinclair Research expanded rapidly; by September 1980, over 20,000 ZX80s had been sold. Clive Sinclair was determined to keep the company to a manageable size; he was all too aware of the need to try to learn from previous mistakes. Bringing manufacturing in-house in the days of Sinclair Radionics had seemed an excellent idea at the time, but the number of people they had had to make redundant had hurt him deeply.

By this time there were 12 employees at the King's Parade offices in Cambridge, six engineers still working at The Mill in St Ives, and Nigel Searle in Boston. To make sure that the company didn't grow too fast Sinclair had subcontracted all manufacturing. To begin with, production was done locally in St Ives by Tek Electronics. Components were generally of a much higher standard than they had been during the Black Watch fiasco, so there was less reason to manufacture products in-house. Eventually, as more and more were produced, the computers were made by Timex in Dundee; it is a testimony to all concerned that the return rate on the ZX80 was only one per cent.

Although the machine was so popular and sold so well, this was largely because it had no competitors. In fact it did have some drawbacks such as the lack of floating point arithmetic, a capacity of only five digits and an inability to handle separate files on its cassettes. The touch-sensitive — or sometimes touch-insensitive — keyboard was unpopular with users too.

But in spite of those shortcomings, the ZX80 had opened a new market sector which exceeded Sinclair's wild-

est dreams, so who was going to complain too loudly? In September 1980, the company launched a 16K RAM pack — an extra plug-in memory — to attach to the edge-connector at the back of the machine. There will be many who remember the well-known RAM pack problem whereby a slight breeze could upset the connection and an evening's work would be lost. Thank heavens for Blu-Tack.

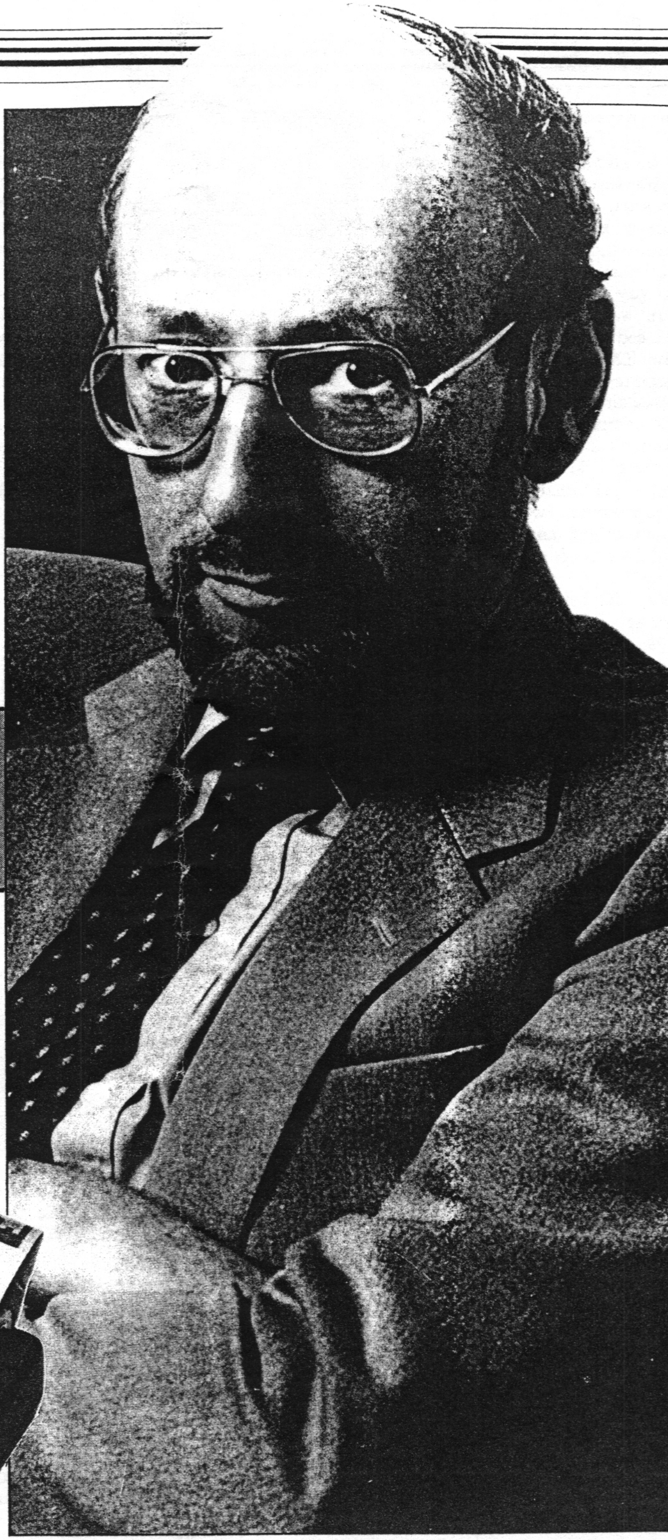
The ZX81 was launched in March 1981. It contained a new chip, designed by Sinclair Research and manufactured by Ferranti — the world leader in uncommitted logic arrays — standard chips which can be adapted to a user's requirements at the last stage of production. The new chip replaced 18 chips in the ZX80 and the machine now retailed at £69.95 or £49.95 in kit form. Sinclair also offered an add-on ROM to convert the ZX80 to the ZX81.

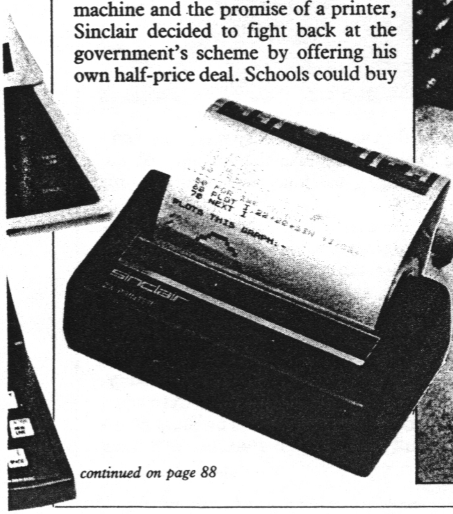
The ZX81 had a floating decimal point and scientific functions. It came in a sturdy black case and, if you used a

Sir Clive's success. The second and final extract from Rodney Dale's Sinclair Story

colour TV, would produce black characters on a restful green background. It was a vast improvement on the ZX80. Sinclair also announced that he would be launching a small printer to work with the ZX81 later in the year.

Now that he had an improved machine and the promise of a printer, Sinclair decided to fight back at the government's scheme by offering his own half-price deal. Schools could buy





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a package of a ZX81 and a 16K RAM pack for £60; and he further promised that they would be able to buy the ZX Printer at half price when it was launched. That made the total cost of system £90, while under the government scheme the minimum a school could pay if it bought an 'approved system' was £130. About 2300 schools purchased the Sinclair package.

The ZX81 received a very sympathetic review from David Tebbitt in *Personal Computer World* in which he keeps referring to 'Uncle Clive'. On the other hand: "Sinclair has been a bit cheeky in his advertisements. Under a column entitled 'New, improved features', he proceeds to mentin three things that were included in the ZX80 when it was launched over a year ago!"

The ZX Printer was eventually launched in November 1981 at £49.95. Designed for the ZX81, it could also be used with the ZX80 with an 8K ROM. It was a very compact little printer using a special metallised paper, and would print 32 characters to a line and nine lines to the inch. You plugged it in to the edge connector at the back of the computer using a stackable socket. The print was clear and readable; the ZX Printer sold well.

The market gradually expanded. In March 1981 Mitsui approached Sinclair Research and towards the end of the year was granted exclusive distribution rights for the ZX81 in Japan. Mitsui was one of Japan's main importers of British goods, the range including Jaguar cars and Burberry raincoats. They planned to market the ZX81 by mail order at about £90 and

Nigel Searle in Boston

aimed at selling 20,000 computers during the first year; there were no competitors.

By the end of January 1982, 300,000 ZX81s had been sold worldwide. In the USA Sinclair was selling 15,000 personal computers a month by mail order; American Express was selling thousands to a potential ten million customers. Then Timex was granted a licence to market both current and future Sinclair personal computer products in the US from mid-1982. They paid Sinclair a five per cent royalty for sales and bought the right to use the Sinclair name in the US.

In Britain, Sinclair signed an agreement to sell the ZX81 through the branching-out stationers and booksellers WH Smith. Today, when so many national stores – Boots, Dixons, John Lewis, and the rest – have sections devoted to matters computery, it is hard to remember what a breakthrough it was to be able to buy the ZX81 in the High Street. Not that other makers were far behind; the numerous retail outlets were just one of the ways in which the home computer created jobs. By February 1982 production of ZX81s was running at about half a million machines a year and the company had a turnover of £30M compared to £4.65M in the year ended March 1981.

Sir Clive dons his running shorts

One of the interesting side-effects of the ZX80 and ZX81 was the number of cottage industries that sprang up because of them, producing software, peripherals and publications. A ZX80 Users' Club had been formed before the ZX81 was launched; *SYNC Magazine* appeared in January 1981 to cater for ZX81 users; *Learning Basic with your Sinclair ZX80* by Robin Norman, published by Newnes in early 1981, was one of the first books to develop Basic programming techniques on the home computer.

Hundreds of small operations started to sell programs, books, extra memory, printers, sound generators and add-on keyboards for use with the ZX81. In January 1982 one Mike Johnston organised a fair for companies selling products for the Sinclair computers. Nearly 10,000 people turned up at Central Hall, Westminster, which has a capacity for only a few hundred; the police had to be called to control the crowds; 70 exhibitors took huge sums of money.

Both the ZX80 and ZX81 had been produced as learning machines; for the person wanting to find out about computer programming. Once people knew what they were doing they wanted a more powerful machine, and at first they had to turn to manufacturers other than Sinclair Research to find them.

Sinclair's philosophy – at least in retrospect – was to prepare the world for universal computer ownership in easy stages. Over 50,000 ZX80s had been sold, and more than six times as many ZX81s. As the market matured, the engineers were working away at the ZX82 (codename) which was launched as the ZX Spectrum in April 1982. The hardware was designed by Richard Altwasser, who later formed his own company, Cantab, and fell by the wayside in an attempt to market a computer called the Jupiter Ace. The software was written by Steve Vickers on contract from Nine Tiles Ltd – the company which had originally provided Sinclair Basic.

Production of the Spectrum started at 20,000 a month and Sinclair expected to sell 300,000-400,000 during the first year. There were two versions: the 16K sold for £125 and the 48K for £175. For those who prefer-

The Timex plant in Dundee

red to work up in easy stages, an extra pack to increase the memory of the cheaper machine was available for £60.

In many ways the Spectrum was altogether a 'better' machine than either the ZX80 or ZX81, although some said its predecessor the ZX81 was superior when it came to finding out how computers actually work. Its chief advantages over the ZX81 were 'eight-colour graphics capability, sound generator, high-resolution graphics – smaller dots on the screen – and many other features, including

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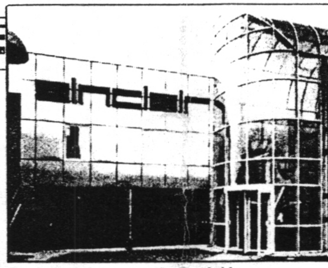
the facility to support separate data files.'

At last, Sinclair Research was notionally able to compete with the BBC Micro and other personal computers; the figures in the table published in the ZX Spectrum leaflet were impressive. The ZX81 had been competing against the Acorn Atom; it could never have stood up against the BBC model A, the current Acorn competitor when the Spectrum came out. The Spectrum had a more versatile Sinclair Basic than the previous two machines; an improved keyboard replaced the unpopular – though cheap – touch-sensitive keyboard; it was able to generate and display graphics using up to eight colours; and it could be linked to other Spectrums to create a communications network.

However when Jim Lennox reviewed the new machine for the late lamented *Technology Week*, he was not impressed by the keyboard – which had been made to simulate moving keys by fitting a one-piece moulded rubber pad over a ZX81-type membrane keyboard, and which had a most peculiar feel to it.

The Spectrum was the cheapest home computer to produce colour graphics but the reviewer complained of the lack of facilities and 'found that the borders tend to wriggle in an irritating way'. It also had a small built-in loudspeaker which generated bleeps 'acceptable for games, but not much more'. And that, to Sinclair's disappointment, was about all the Spectrum was generally used for. The



Sinclair's headquarters in Cambridge

tone of the review was set in the first paragraph:

> "After using it, however, I find Sinclair's claim that it is the most powerful computer under £500 unsustainable. Compared to more powerful machines, it is slow, its colour graphics are disappointing, its Basic limited and its keyboard confusing."

But never mind the reviewers; the Spectrum is without doubt the most commercially successful home computer ever. It was after the launch of the Spectrum that computer fever really took off; children were being introduced to computers at school and the very cheapness of the ZX80 and 81 meant that parents were prepared to buy them to give their children 'a good start in life'.

The place of the computer in the

The launch of the Spectrum

home was reinforced by the meagre provision in schools, where there was often only one machine between 30 pupils and thus insufficient opportunity for everyone to practise. What better solution than a computer at home?

But Sinclair observed another dimension: "The interesting thing is that as well as children being expert at programming, there is another expert group taking to it like ducks to water — retired people. The concept of it being peculiarly suitable to the young mind is perhaps wrong — it's the mind that's free of everyday burdens. The retired person with some time to spare can take to it wonderfully and it's giving a lot of people a new interest in life."

The first home computers had no software; to play a game on one you either had to make it up yourself or buy a magazine with a program in it — which was very good for the magazine industry — and type in the program before you could start to play. Now the Spectrum with its 48K memory was capable of playing very sophisticated games and there were companies starting up solely to produce them — often run by very young people who had learnt programming at school or from magazines.

In February 1983, WH Smith, who had been the Spectrum's biggest distributor, was joined by Boots, Currys, Greens — Debenham's in-store subsidiary — and John Menzies as Sinclair pioneered a change in the High Street. Many other stores such as John Lewis and the House of Fraser were supplied by Sinclair's UK distributor, Prism Micros. 200,000 Spectrums had now been sold by mail order, and by Easter 12-15,000 Spectrums were being sold per week in the UK. The Spectrum had also been launched in more than 30 countries worldwide.

You couldn't walk into WH Smith on a Saturday without being faced with shelves of software and mobiles and whizz-kids playing on the computers. What sort of computer you had became an important factor in playground status.

And where has it all led? Computer awareness has been generally raised; the dust has settled, much of it on the home computers, leaving a hard core of enthusiasts. The market is saturated; the craze is over. The computer is settling into a serious niche comparable with ham radio; the days of the CB computer are surely over.

Anger growing over delays in delivery

ANGER is growing among the many people still waiting for their Spectrums up to 10 weeks after placing their orders. Accusations have been made that the customer service department at Sinclair Research has been quoting 28 days' delivery for new orders, despite knowing they could not be met.

One person who contacted *Sinclair User* said that on the basis of the department's assurances he had ordered a Spectrum for his son's birthday. "He sold his ZX-81 expecting to have his Spectrum and then the order was returned when Sinclair said it could not meet the delivery date," he said.

Ronald Harris of Swansea said he had been waiting since the end of May. "I have the feeling I am just being strung along and that I haven't been told the truth. I wouldn't mind so much if I was told how long it would be but to keep telling me it will be another three weeks is not right.

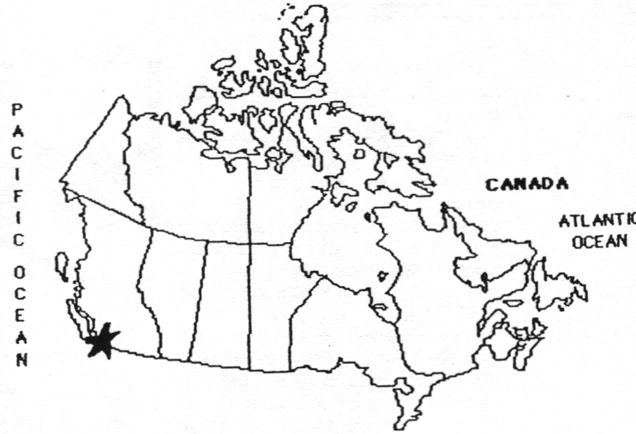
"What annoys me is that it will be about three months from order when I get my Spectrum but the order forms still say to allow 28 days for delivery."

A spokesman for Sinclair Research said that the company regrets the delays, which were now about eight weeks for new orders. He added that the problems had been caused by the level of response, which is much higher than expected.

The launch of the Spectrum had been based on the experience of the ZX-81 but order levels had been even higher.

Based on the latest information, which is changing from day to day, it is estimated that delivery time should be down to 28 days by the end of September. In the meantime, the spokesman said that the company will be notifying people regularly of the position.

He added that if customers telephone the distribution depot quoting their order, they should be able to receive some idea of when the order would be despatched but it would not be possible to give an exact date.



VSUG

The Vancouver Sinclair Users Group has been in existence since 1982. We are a support group for the owners and users of all SINCLAIR and TIMEX computers.

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